

Comment (Case 3703) – Response to a comment on the proposed designation of a neotype for *Nautilus pompilius* Linnaeus, 1758 (Mollusca, Cephalopoda, Nautilida)
(see BZN 72(4): 274–285 [Case]; 73(1): 48; 73(2–4): 136–138)

Svetlana V. Nikolaeva

Department of Earth Sciences, The Natural History Museum, London; SW7 5BD, U.K.; Borissiak Paleontological Institute, Russian Academy of Sciences, ul. Profsoyuznaya 123, Moscow, 117997 Russia; Kazan Federal University, ul. Kremlyovskaya 4/5, Kazan, 420008 Russia (e-mail: s.nikolaeva@nhm.ac.uk)

W. Bruce Saunders

Department of Geology, Bryn Mawr College, Bryn Mawr, Pennsylvania 19010, U.S.A. (e-mail: wsaunder@brynmawr.edu)

Royal Mapes

Department of Biological Sciences, Ohio University, Irvine Hall, Athens, OH 45701, U.S.A. (e-mail: mapes@ohio.edu)

A. Louise Allcock

Ryan Institute and School of Natural Sciences, National University of Ireland, Galway, University Road, Galway, Ireland (e-mail: louise.allcock@nuigalway.ie)

<http://zoobank.org/urn:lsid:zoobank.org:pub:94D86181-8C99-41E6-B859-35C31E095D7D>

These comments are made in response to the criticisms outlined in I. Gleadall's comment on Case 3703 submitted to the Commission Secretariat and to the authors (see Gleadall, 2017).

1. Gleadall believes that the five (he incorrectly says “six”) available ‘syntypes’ are sufficient for recognition of the species, and that the neotype designation is unnecessary. There are several incorrect assumptions in his main line of argument, which we will explain below.

2. Gleadall does not appreciate that not all of the presumed ‘syntypes’ are actually confirmed syntypes. Of five historical specimens now in collections, only two subadult specimens in the Uppsala collection can be confirmed to have been specimens known to Linnaeus prior to 1758. The remaining three specimens (a juvenile in the Linnean Society in London, one adult specimen in Uppsala (no. 880), and a broken and etched specimen in Uppsala) are not confirmed syntypes. This is clearly outlined in the proposal and backed by the historical study by Nikolaeva (2015). For the sake of clarity we will briefly summarize the status of these specimens here. Extensive historical documentation is presented by Nikolaeva (2015).

(a) There is no evidence that the juvenile specimen in the Linnean Society in London was known to Linnaeus prior to 1758 (the specimen is not mentioned in any edition of *Systema Naturae*, and there is no original label). It could have been placed in the collection at any time before 1823. Gleadall writes “... shell of a young animal in the Linnean Society collection: this is a syntype (whatever its developmental stage or condition) because it was a specimen identified as *Nautilus pompilius* and possessed by

Linnaeus". This statement confuses the concept of syntypes, which are parts of the type series (Articles 72.4 and 73.2 of the Code); the type series includes only those specimens that served as part of the basis for the original description, and not just any specimens identified as the species in question and possessed by the author in an unspecified period of the author's life.

(b) There is no evidence that Linnaeus handled specimen no. 880 in Uppsala before 1758. It is not included in the 10th Edition of *Systema Naturae* (1758), and was mentioned for the first time by Linnaeus in 1767.

(c) The broken and etched shell in the Uppsala collection is most certainly not a syntype, because the original specimen apparently known to Linnaeus had an illustration of insects (Holm, 1957), whereas the shell housed now in the Uppsala collection has an engraving of a pig.

(d) Gleadall concludes that "the logical action to follow would be to redescribe the species *Nautilus pompilius* with reference to the six available syntypes, accompanied by morphological information from a selection of new voucher specimens at different growth stages and corresponding DNA sequences". However, no subsequent re-description of *Nautilus pompilius* based on the two subadult confirmed syntypes can possibly clarify the concept of this species, and it is also possible that they do not even belong to this species. The remaining three 'syntypes' should not be taken into consideration because of their unconfirmed syntype status.

3. Gleadall further says that the authors stated that Ambon could only be assumed as the possible type locality if one of the Rumphius specimens were to be designated as lectotype (or if that happened to be the locality of a valid neotype designation), otherwise the type locality is interpreted as the locality, where known, of each of the specimens in the syntype series. Gleadall says that no locality data are given by the authors of the application for any surviving specimen. This is indeed the case, but the data were not omitted because of the carelessness of the authors, but because these localities are not known. Linnaeus' original description (1758) simply says 'India'. There is indeed a good, logical case to be made for Ambon, Moluccas Is., Indonesia being the type locality, though strictly speaking it is not known where the specimens that Rumphius figured nor the 'syntypes' of Linnaeus were/are actually from. Rumphius stated that *Nautilus* occurs in that region. Similarly, there is no way to know where the various possible syntypes were from within the broad range of *Nautilus pompilius*, nor, in some cases, whether they are even *N. pompilius* s.s. or one of the various other 'shell' species that were named (e.g., *N. repertus*, *N. stenomphalus*, *N. belauensis*, and possibly even *N. macromphalus*) because of the state of preservation, size, etc.

4. There is no consensus on the number of 'historical' species of *Nautilus* (those based on phenotypic characters). Even since the first genetic/electrophoretic studies of Woodruff et al. (1987) and in 17 DNA works since Wray et al. (1995) (see Saunders & Landman, 2010) speculations have ranged from between one and seven, with sibling, geographically isolated-, sympatric- phylogenetic-, etc. terms being used by various authors. It might be that there is only one 'superspecies' (*N. pompilius*) with a series of geographic subspecies, with various 'historic' endemics (e.g., *N. p. macromphalus*, *N. stenomphalus*, *N. belauensis*, *N. repertus*, *N. suluensis*); and possibly *Allonautilus scrobiculatus* with *A. perforatus* as additional species or subspecies. These were mostly originally based on shells and most are endemic, and all occur within the geographic range of *N. pompilius*. A few may be sympatric (e.g., *N. stenomphalus* and *N. pompilius*

on the Great Barrier Reef [with hybridization?], *A. scrobiculatus* with *N. pompilius* in Manus, Papua New Guinea [and probably elsewhere]). *N. p. suluensis* was named as a subspecies, no genetics have been published, and its only known occurrence (Tubbataha Reef, Sulu Sea, Philippines) is a marine reserve that is difficult to access (but which may serve to protect it). However it too is well within the range of *N. pompilius* and it may even be sympatric with it.

5. Most material referred to as *N. pompilius* (live-caught and shells) is just assumed to be *N. pompilius* s.s. which has traditionally been assumed to occur in the Philippines, but Philippines material (we now know) differs from the material from Ambon, Indonesia, Papua New Guinea, Samoa, Australia, etc. The problem is, there has never been documented material from Ambon to compare with until now: this is the ‘new material’ Gleadall referred to which was collected by Saunders in Ambon in 1987, and referred to in Bonacum et al. (2011), Nikolaeva et al. (2015), etc. and is being described in detail by Saunders et al. (in review). A real, documented, localized neotype is needed to be able to establish what is and what is not *N. pompilius* s.s. This cannot now, or likely ever, be done using the available ‘possible syntypes’ and until a bona fide neotype is available to rectify this, there will continue to be this vague concept of what the type species, *N. pompilius*, is . . . but bear in mind, the available ‘possible syntype’ material may not even be from the Ambon, Indonesia region; it is not known.

6. Gleadall says that we acknowledge that the proposed neotype is consistent with what is known of the shell pattern and morphology of syntypes and from other sources and agrees with the prevailing usage. He concludes from that, that “Since the proposed neotype was identified with reference to the syntype series, the latter takes precedence as type material and, on the evidence provided, there is no justification for designating a neotype”. However, the statement of the proposed neotype being consistent with what is known about the species and with prevailing usage is an integral part of a neotype designation and is made in strict adherence to the requirements of Article 75 of the Code. This statement in no way implies that a neotype is not necessary if a specimen proposed as a neotype is consistent with what is known about the species. It simply states that all necessary precautions have been taken to maintain stability and prevailing usage, which is in line with the Code and best taxonomic practice.

7. Gleadall believes that for this species, “the only potential problems affecting the type material and its designation seem to be the identification and locality of each of the syntypes. If any were to be identified as a different species or subspecies, it could be removed from the syntype series during a redescription of *Nautilus pompilius*, and designation of a lectotype could be considered”. This is a confusing statement because, as we explained in the application, only two subadult specimens in Uppsala are unequivocal syntypes, and their identification is indeed problematic. They may belong to any subspecies of *Nautilus pompilius*, or even to a different species, and there is no way to identify them more precisely. In addition, a lectotype identification (albeit unnecessary in this case) will most certainly require a Commission action, because it is not possible to establish among the more than 500 published papers on *Nautilus* (Saunders & Landman, 2010), whether or not a lectotype has been already inadvertently designated by citing any specimen (surviving or illustrated) as type prior to 2000 (under Article 74.6 of the Code). To establish a neotype based on well localized live-caught material, with shells and soft parts, genetic and population data, ecological information, with associated fauna, etc., would anchor, once and for all, what *N. pompilius* is. It would provide a set of both

phenotypic and genetic characteristics that in some cases differ from other named species and the many known isolated population variants of *Nautilus pompilius* that have been or may be named as new species or as subspecies of *Nautilus* (e.g. *N. belauensis* (Palau), *N. repertus* (NW Australia), *N. suluensis* (Philippines), plus a described but unnamed form from American Samoa, etc.). There are a number (hundreds?) of other new and/or differing populations out there that have not yet been discovered or described (e.g. Vanuatu). Without solid data belonging to a certifiable type specimen of the type species from the type locality providing phenotypic characters like mature size, umbilical shape and closure (callus), color pattern, shell sculpture, aperture shape, etc., which cannot be determined from existing potential syntype material, there will probably never be solid, fact-based resolution of the various species (in particular, *N. pompilius*), or other named species, subspecies, variants, etc., using phenotypic and genetic characters. The extent to which molecular studies will resolve the status of these various forms remains to be determined. At present, there seems to be such disagreement and uncertainty that in many ways there has not been much progress since the first cladograms, which were based on electrophoresis by Woodruff et al. (1987).

While more background could possibly have made the proposal easier to follow and digest, we are not sure that there is a need to present a treatise on nautiloids to accompany the proposal for designating a neotype, when there are fairly recent and complete accounts of the historically phenotypic-based species, subspecies and even variants already out there (e.g. Saunders, 1981, 1987; Bonacum et al., 2011; Jereb, 2005). The recent and current appearance of new molecular studies of *Nautilus* and *Allonautilus* would make any attempt at synthesis incomplete at best given the lack of information available about the phenotypic characteristics of the Ambon population, which should, of course, be linked to the genetic data that just recently were obtained from the same Ambon, Indonesia material (and to an additional new Indonesian population from Sumbawa, Indonesia; Saunders et al., in review). The status of types in other extant nautiloids is not much better than that for *N. pompilius*. Only *N. belauensis* (Palau) was described and named with access to repositated soft parts and was supplemented by electrophoretic analysis, and later by DNA. (The description of *Allonautilus* was also, but the whereabouts of the types are unknown.) While a systematic effort to revise all nautiloid taxonomy would be admirable, a major impediment to this happening is and has been the muddy history and circumstances surrounding typology of the type species, which Nikolaeva et al. (2015) unraveled. Unquestionably, establishing a strongly based neotype for *N. pompilius* would be an important precedent and would go a long way toward clarifying what the type species of *Nautilus* really is, and it would unquestionably be quite helpful in aiding evaluation of the status of *N. stenomphalus*, *N. macromphalus*, *N. repertus*, *N. belauensis* and *A. perforatus* (for which a deposited holotype really does exist!).

8. To summarize, *N. pompilius* is by far the best-known and most commonly encountered (and trapped and marketed) species of *Nautilus*. But there is, until now, almost no information on the type species in its type locality; indeed, almost nothing new or substantive on Indonesian *Nautilus* has been published since Rumphius in 1705! This is being rectified, literally as this is being written (Saunders et al., in review) with a wealth of new morphological, ecological and genetic data from Ambon and a new, additional Sumbawa population (which appears identical to the former). The designation of a neotype from Ambon would end the uncertainty that has resulted from not having unquestionable, adequate type material of *N. pompilius*.

References

- Bonacum, J., Landman, N.H., Mapes, R.H. et al.** 2011. Evolutionary radiation of present-day *Nautilus* and *Allonautilus*. *American Malacological Bulletin*, **29**: 77–93.
- Gleadall, I.G.** 2017. Comment (Case 3703) – A statement against the proposed designation of a neotype for *Nautilus pompilius* Linnaeus, 1758 (Mollusca, Cephalopoda, Nautilida). *Bulletin of Zoological Nomenclature*, **73**(2–4): 136–138.
- Holm, Å.** 1957. Specimina Linnaeana. I Uppsala bevarade zoologiska samlingar från Linnés tid. *Uppsala Universitets Årsskrift*, **1957**: 1–68.
- Jereb, P.** 2005. Family Nautilidae. Pp. 51–55 in Jereb, P. & Roper, C.F.E. (Eds.), *Cephalopods of the world. An annotated and illustrated catalogue of cephalopod species known to date*, vol. 1. FAO Species Catalog for Fisheries Purposes, no. 4. F.A.O., Rome.
- Linnaeus, C.** 1758. *Systema Naturae*, vol. 1. 10th Edition. 824 pp. Salvii, Holmiae.
- Linnaeus, C.** 1767. *Systema Naturae*, vol. 1. Part 2. 12th Edition. 795 pp. [pp. 533–1327]. Salvii, Holmiae.
- Nikolaeva, S.V.** 2015. A study of the type series of *Nautilus pompilius* Linnaeus, 1758 (Mollusca, Cephalopoda, Nautilida). *Zootaxa*, **3963**(1): 055–073.
- Nikolaeva, S.V., Saunders, W.B., Mapes, R. & Allcock, A.L.** 2015. Case 2703. *Nautilus pompilius* Linnaeus, 1758 (Mollusca, Cephalopoda, Nautilida): proposed designation of a neotype. *Bulletin of Zoological Nomenclature*, **72**(4): 274–285.
- Rumphius, G.E.** 1705. *D'Amboinsche rariteitkamer, behelzende eene beschryvinge van allerhande zoo weeke als harde schaalvisschen, te weeten raare krabben, kreeften, en diergelyke Zeedieren, als mede allerhande hoorntjes en schulpen, die men in d'Amboinsche Zee vindt: Daar beneven zommige mineraalen, gesteenten, en soorten van aarde, die in d'Amboinsche, en zommige omleggende Eilanden gevonden worden.* [xxviii], 340, [43] pp., 60 pls. François Halma, Amsterdam.
- Saunders, W.B.** 1981. A new species of *Nautilus* from Palau. *The Veliger*, **24**:1–7.
- Saunders, W.B.** 1987. The species of living *Nautilus*. Pp. 35–51. Chapter 3, in: Saunders, W.B. & N.H. Landman (Eds.), *Nautilus: The Biology and Paleobiology of a Living Fossil*, Plenum Press, New York & London.
- Saunders, W.B. & Landman, N.H.** (Eds.). 2010. *Nautilus: The Biology and Paleobiology of a Living Fossil*. 632, lxxvii pp., 270 figs. Springer Press, NY. (Reprint of Saunders & Landman, Eds. 1987, with additions.)
- Saunders, W.B., Mapes, R.H., White, M.M., Hastie, L.C. & Yaqin, K.** (In Review). *Nautilus pompilius* Linnaeus, 1758, from the type area, Ambon, Molucca Is., and from Sumbawa – Lombok Islands, Indonesia. *Malacological Bulletin*.
- Woodruff, D.S., Carpenter, M.P., Saunders, W.B. & Ward, P.** Genetic variation and phylogeny in *Nautilus*. Pp. 65–83 In: *Nautilus. The biology and paleobiology of a living fossil*. Reprint with additions. Springer, Dordrecht, Heidelberg, London, New York. (The first edition was published by Plenum Press, New York in 1987.)
- Wray, C.G., Landman, N.H., Saunders, W.B. & Bonacum, J.** 1995. Genetic divergence and geographic diversification in *Nautilus*. *Paleobiology*, **21**: 220–228.